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ABSTRACT

This is the annual report of the activities of Israel Science Teaching Centre for 1971-1972. The contents of the report include reports of meetings and activities undertaken in various projects in mathematics, physics, chemistry, biology, agriculture, and the junior school program. Some major activities of different projects include inservice teacher education programs in mathematics and biology, and individualized instruction for junior school programs. Instructional materials have been revised or prepared in chemistry, biology, physics, and for elementary schools. The materials in agriculture have been translated in Arabic language and instruction is based on topics suitable for Israel. A total of 22 units are in different stages of development for kindergarten through grade five. (PS)

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ANNUAL REPORT ON ACTIVITIES

ISRAEL SCIENCE TEACHING CENTRE

1971 - 1972

ED 015 846

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The Amos de Shalit Science Teaching Centre, Israel

ANNUAL REPORT ON ACTIVITIES
ISRAEL SCIENCE TEACHING CENTRE
1971 - 1972

I. Meetings

During the past year the Council met seven times and the Executive Committee five.

II. UNDP experts, Fellowships and Guests

Experts

D. Segaller - held a course on film production
Prof. E. Mendoza - physics curriculum development
Mr. M. Harrap - physics curriculum development
Dr. R. Kempa - chemistry curriculum development
Mr. B. Choppin - evaluation of new science curricula
Dr. Shuttle and Prof. Goldstein - education panel
Dr. Joel
Prof. H. Their - under UNESCO Regular Program: Junior Science
Prof. E. Kaplan - under UNDP Technical Assistance: Junior Science

Guests

Dr. M. Steinberg - spent three months working at the Centre on problems of mathematics education.

Dr. Grebegki - from UNESCO, visited Israel in connection with the education program on the topic "The Human Body", and organization of supply centers.

Prof. Katz - from Australia, visited the Center and expressed interest in the general organization of science education research in Israel

Prof. E. Goodlad - from the University of California, visited the Junior Science Project at Tel-Aviv University

Miss E. Biggs - held a course on new approaches to the teaching of mathematics

Mr. Hakenson - UNESCO expert for instrument development in Thailand, visited the Weizmann Institute of Science and Kfar Ruppin

Mr. Pritchard - Director of the Nature Reserves Authority in England, visited the Center and lectured on the problems of the nature reserves and education. He was sponsored by the English Committee.

Father P.S. Sdeiter - from the Philippines, visited the Science Teaching Center, held discussions at the Weizmann Institute, and visited Kfar Ruppin.

Prof. Bruckheimer - of the Open University, U.K., also visited the Center.

In addition to the abovementioned guests, the Center organized for UNESCO an intensive educational tour for a group of eight biologists from Thailand who are developing a new biology education program there.

Fellowships

1. The following fellowships have not yet been utilized:

   Dr. Ruth Ben-Zvi - 3 months - chemistry
   Miss Aviva Rabinovitch - 3 months - film production
   Technion - short tour on the subject of vocational education
   Dr. Daviv Chen - short tour in connection with Junior Science.

2. The following have applied for fellowships but have not yet travelled abroad:

   Tamar Reiner
   Ben-Baruch
   Nathan Orpaz
   Mirian Ben-Peretz
   Naomi Arnon

III. Activities in the various projects

1. Mathematics

(a) Mathematics for Grades 7-9 (Jerusalem Group)

During the 1971-72 school year about 80 classes studied according to the program of this group, under direct supervision. These included a number of classes in Junior High Schools and Elementary Schools in the Jerusalem area, who had expressed an interest in participating in this program. The schools were referred to us by the supervisors. In addition, individual chapters of the study program were taught in about 300 classes (the estimate is based on the sales of the books) including classes in Kibbutzim, elementary schools and even high schools.

The following textbooks were published during the year.

1. Levels A and B - Algebra (grades 7-9) written by Prof. M. Mashler.
2. Levels A and B - Geometry
3. Level C - Algebra (grade 7) and Geometry (grade 8) have already been published. (These were previously printed in experimental editions). Texts for the remaining grades are still in the writing stage.
4. Teacher's Guides were developed by the members of the group for Algebra, levels A and B, and for the C-level texts.

Meetings with teachers were held about every 5-6 weeks in Jerusalem and Tel-Aviv. At these meetings the teachers reported on activities in their classrooms and heard several lectures on mathematical and didactical topics. With the completion of each chapter, teachers were asked to report on the rate of progress, any problems they may have encountered, and on tests and range of marks achieved by the students. Each report received a written answer which contained a general evaluation, suggestions for possible improvements, etc.

Because of manpower shortage, we did not visit the classes often, but when we did the main purpose of the visit was to test the program rather than to instruct the classroom teachers.

Teacher instruction courses

So far, one course, for elementary school teachers has been held, in Jerusalem. The teachers met twice for two weeks during the summer and at weekly meetings during a three year period. During this time they studied the grade 7 and 8 Algebra texts and Euclidean geometry. This course does not qualify a teacher to take Grade 8, but it does serve a purpose in that it encourages teachers to participate in

courses which do qualify them, and in that they can gain experience in teaching the subject matter under experimental conditions.

(b) Mathematics for Grades 7-9 (Rehovot Group)

Texts published

The C-level texts were completely revised, to try out a new approach to the problem of this level. The emphasis was put on small teaching units and the texts were prepared in the form of self-study workbooks.

The teachers' guides were developed and enlarged.

Because of the large influx of teachers without any formal background in mathematics, other forms of teacher training - including model lessons in established schools - became an increasingly important activity of the group during the year.

The second part of the text on Euclidean geometry for levels A and B was prepared and a follow-up of their first use in classrooms was carried out. A statistician has been added to the group, as part of the effort to strengthen the follow-up. With her help a new computer program has been written, which will help to evaluate the large amount of information coming into the Center via tests which are sent to all participating schools 2-3 times a year.

The Rehovot group and the Jerusalem group have been collaborating to develop a mathematics program which will facilitate a smooth transition from the Rehovot program for grades 7-9 to the Jerusalem program for grades 10-12.

(c) Mathematics Grades 9-12

During the 1971-72 school year the Amitzur experiment was extended to 6 additional 4-year high school and 14 grades-10 of the 3-year senior high school. In addition to these 14 senior high schools, 5650 pupils participated in the experiment.

The follow-up was carried out by Prof. Amitzur, the regional supervisor for mathematics education, Mr. A. Marcus, and Dr. P. Katz. Each month two meetings were held: one with 4-year high school teachers, and one with the senior high school teachers. Discussions at these meetings centered aroung the pupils' progress, and on problems which had arisen during teaching of certain chapters. In addition two tests were given: one at the beginning of the school year to asses the state of knowledge of pupils coming from elementary school, and another after they finished Book I, Algebra. The first test also contained questions on the material still to be learned in grade 9, so as to be able to assess progress by the end of the year.

The second test was an achievement test of the material in Book I, Algebra, and showed satisfactory results. The tests were prepared by the Science Teaching Center and were given in all the schools at the same time.

The purpose of the follow-up is three-fold:

1. To assess student achievement
2. To determine suitability of the new books to the purposes of the experiment.
3. To determine the progress of teachers in the teaching of certain chapters according to the instructions given in the experiment.

Taking advantage of the experience accumulated from teaching the various chapters, and also on the basis of discussions with teachers and in the Science Teaching Center, two new textbooks were written during the past two years for grades 9 and 10, as well as several chapters of the third book. One group is currently writing a chapter on Trigonometric functions and another a chapter on functional equations and a chpater on the exponential logarithmic functions.

This summer, as in the past, we held a 2-week course for teachers newly joining the experiment, in cooperation with the Department for Teacher Training of the Hebrew University. The course included instruction in methods of teaching the material and solving problems as well as lectures on mathematical and didactical topics.

Future plans:

Preparation of instructional material and textbooks:

With the expansion of the experiment new teachers with little expetience are joining it. This will make it necessary to write a teacher's guide to advise the teacher in the selection of exercises and problems (from the textbook) best suited to classes at different levels, and also to develop and clarify the main ideas to be emphasized in the teaching of the different chapters.

Geometry:

The Amitzur program in geometry is only a temporary one. The preparation of a geometry program which fulfills the purposes of the experiment and which enables a better integration of algebra with geometry is one of the problems on which the center has been working for a long time. During the 1971-72 school year, Prof. Amitzur held a seminar on the teaching of geometry, and several approaches and ideas were analyzed. As a result of the discussions held in the seminar, a limited experiment is being carried out in grades 9, on plane geometry. This experiment is being carried out by Nurit Zahavi in Junior High School grade 9 of the New High School of Rehovot. Miss Zahavi participated in the seminar and wrote the booklet

for the experiment. It is hoped, that this experiment will help in the preparation of a new study program in geometry.

Follow-up and guidance

Past experience shows that in addition to the monthly meetings and teachers' guides, a constant follow-up of the teachers' work in the classroom is necessary. Classroom visits enable the guidance of the teacher during his work and also, important informati about the progress of the experiment is obtained.

Last year, for the first time, an attempt was made by the Center, to evaluate student achievement systematically. Dr. Choppin, UNESCO expert, participated in this evaluation attempt. In our opinion an evaluation group should be organized within the Center, which would constantly and systematically follow student achievement and their reaction to the material.

2. Physics

(a) Physics (Grades 7-9)

During 1971-72, four chapters of "Electricity" for Grade 8 appeared in a second experimental edition and a second follow-up was carried out. These chapters were then rewritten for the commercial edition, Part 1 of which has now been published. Part 2 is currently in press.

The experimental edition of the teacher's guide was printed in 1971/72. Part 1 of the commercial edition is now in press and Part 2 is being prepared and will appear during 1973.

The first draft of two chapters of a special edition was prepared during 1971/72 and a follow-up was carried out. These chapters are now being rewritten and the commercial edition will appear during 1972/73.

The course on Gases is being rewritten, and after a second follow-up the commercial edition of the textbook will be prepared.

(b) Physics (Grades 9-12)

As a result of a decision made by the Committee on Physics Education, a temporary program for Grades 9 of Junior High School was prepared. This program is based on that of Grade 9 in the four year High School.

(Materials and their properties). A teacher's guide was written to accompany this temporary program. Also, study days and instruction courses for grade 9 junior high school teachers, were held.

New experiments were developed and an experimental edition of the teacher's guide "Laboratory manual for optics and waves" was published, as a first step in the adaptation of an optics program for grade 11 (which will later become the Grade 10 optics course).

As a continuation of the Grade 11 textbook - Mechanics - originally written for mathematics-physics majors, the first three chapters of the teacher's guide have been printed and distributed among the teachers.

The first experimental edition of the Grade 10 physics program for mathematics-physics majors was completed and published.

Experiments for the Grade 12 electricity course, have been developed and the corresponding chapters written. Half of these were published in a booklet - Electricity for Grade 12, Part I; the remainder will appear in the booklet Electricity for Grade 12, Part II. The third and last booklet in the series decided upon for Grade 12 will be "Chapters in Modern Physics".

A committee was set up with the cooperation of Mr. I. David, the physics education supervisor, for setting the first matriculation examinations according to the Rehovot plan.

In cooperation with the Physics Teachers' Association in Israel, publication has begun of a teacher's bulletin - "Gilyonot" (Pages). Numbers 1 and 2 have already been published.

A course on the subject "Physics Teaching in High School" was held during the first semester of 1972-73 school year, at the Feinberg Graduate School, with the intention of making students acquainted with problems of high school physics.

During the summer of 1971, courses were held for teachers of the Rehovot plan in Grades 9-12, and also for laboratory technicians and laboratory centers. During the school year, study days and laboratory instruction on a variety of topics, were held.

The various experimental programs have been followed up, and also the direct help and counsel to schools teaching the Rehovot plan have been continued.

(c) Teachers' Seminars (STC Jerusalem)

Until now, the group has worked only on the program for the first graduating class. The number of hours devoted to physics is 300 (including laboratory time). It was decided that the basic student text for reading and study will be "Physcis for the Inquiring Mind" by E. Rogers, since this book present physics from a conceptual and an historical approach through the emphasis of the paths of research and scientific discovery. Since the number of seminaries training Junior High School physics teachers is small, it was thought possible at this stage to forgo the publication of a teacher's guide and rely instead on personal instruction given by members of the group.

Two hundred copies each of two booklets, the translation of the first part of Rogers' book, have already been printed. The group is now working on booklets three and four, which will be the translation of Part III of the book. A laboratory manual, containing experiments corresponding to the first two booklets, has been published. A second laboratory manual is being now prepared (part of it is already at the printer's) to accompnay Part III of Rogers' book.

The first booklet has been tested in Jerusalem by the Lifshitz Seminary, and in Tel-Aviv by the Shein Seminary.

The two booklets published to date, were tested at courses for Junior High School science teachers in Jerusalem (under the auspices of the Hebrew University) and in Oranim.

So far only tentative conclusions are possible, but it is clear from these courses that it is not advisable to begin studying physics, until the students have had at least 50 or 60 hours of mathematics. We do not yet know wh ther the same situation will be obtained in the Seminaries, where the students are younger and correspondingly closer to their basic studies.

The general reaction to Rogers' book, is that it is pleasant and interesting. Nevertheless, it is already clear that the rate of progress in these courses is even slower than we had anticipated, and that it will not be possible to cover all of the material in the allocated 300 hours, including laboratory time. During the summer vacation, we intend to hold a course of a few days' duration for teachers in Seminaries, in the hope that this will enable them to teach our material more fully. It will take at least one year until we can evaluate more seriously the experiment on the first graduating class.

3. Chemistry (Grades 10-12)

With the development of the reform program in the education system in this country, more and more students are receiving the physics-chemistry program of the Junior High School. Within a few years from now students will be arriving at High School with a considerable amount of information and experience in the exact sciences. The study programs that are presently available in Israel were originally planned for pupils with no previous experience in this field, and are less suitable for schools where most of the students will have been through the Junior High School program.

In view of this, the chemistry group decided to concentrate most of its efforts in the preparation of a study program adapted to the new conditions. One clearly cannot postpone work on a program until it is actually needed in the classroom, since the appropriate material has to be ready in advance, to be ready when the need for it arises. The chemistry program was written in such a way that in its present form it can be first tried out in Grade 10. Part of the first chapters will later be revised according to the needs of the pupils.

During this past year the three-year program was worked out along general lines and also the text and teacher's guide for Grade 10 were written. The book contains seven chapters, with background material for the students, experiments, and summary questions. Not all of the problems presented are solved in the body of the text, since the book is intended to accompany the laboratory work and class discussions.

The book will be tested in seven experimental schools, and rigorous follow-up will be made of its reception in the classroom.

The group working on the preparation of a chemistry-physics program for the Junior High School at the Ministry of Education's Center for Study Programs decided, after consultation with the Chemistry Group in Rehovot, to include chemistry in the second half of the Grade 8 study program (about 30 hours). The Rehovot group was asked to prepare the appropriate material on the subject. The first draft has already been prepared and will be given to members of the Science Teaching Center and Center for Study Programs for their comment.

Two types of teacher instruction courses were held this year:

1. Methods courses:

During the 1971-72 school year a course on the Rehovot plan (CHEMStudy program) for Grade 10 teachers was held in Rehovot. It took place in the afternoons, and 24 teachers participated in it. Parallel to

this, a course was held in Haifa, on the same subject, in which 26 teachers participated. Each of the two groups met about 10 times.

During the summer vacation, a five-day concentrated course was held, with twenty-one teachers participating. The purpose of this course was to introduce the new program to those who will teach it during the next school year in the experimental classes.

2. Instruction courses on specific topics.

The need has long been felt to enable teachers to deepen their knowledge of modern chemistry, even though this additional knowledge may not be used immediately in the classroom. In response to this need the chemistry group held two instruction courses, one during the school year and the other during the summer vacation.

In the course held during the school year three subjects were offered: Polymers and plastic materials, Spectroscopy, and Radioactivity. The instructors were from the Weizmann Institute of Science and the Atomic Research Center at Nahal Soreq. The twenty-four teachers who participated did laboratory work and visited the Atomic Research Center.

In the summer a course on Energy and Chemical Systems was offered. The lectures were given by Dr. R. F. Kempa of East Anglia University, at the time on assignement in Israel as UNESCO expert. The thirty teachers who participated in this course performed many laboratory experiments, some of which may be applicable in their work in the schools.

Matriculation Examinations in Chemistry

The results of the 1971 matriculation examinations were summarized by the chemistry group and an analysis of the results was published.

In 1972, the chemistry matriculation examinations based on the Rehovot program (CHEMStudy) were taken for the fourth time. A staff of writers prepared a "bank" of suggested questions for inclusion in the examination, and a committee of three - Dr. D. Samuel, Dr. R. Ben-Zvi and Dr. A. Persky, selected appropriate questions from these, and also worked on the final editing of the examination and supervised the final production stages.

Of the 450 pupils who took the matriculation examination 179 took the external one. These examinations were sent to be corrected first to the Chemistry Group in Rehovot, and then to Dr. Rivka Barashi and Dr. Dvora Kimhi in Haifa.

Chemistry Teacher Bulletin

The publication of the bulletin the "Chemical Bond" that appeared for the first time in 1971, was continued this year. As last year, three bulletins will be published, each containing a variety of material; informative articles, suggestions for experiments, book reviews and more. About 200 teachers already renewed their ubscription for a second year and a few teachers from the field contributed to the bulletin by submitting material for publication.

Mr. Avraham Hofstein, of the Rehovot Chemistry Group, initiated the publication of a collection of articles on specific chemical topics from "Science". The collection contains articles on general chemistry, bio-chemistry, methods of determining chemical structures, chemical industry, atomic chemistry and the history of chemistry. This collection is sold to interested students.

4. Biology

(a) BSCS Biology Project (Grades 9-12)

Although participation in the BSCS program is voluntary, the number of classes and students taking this program continues to increase. Table I shows an assessment of the number of pupils in various grades according to the curriculum they are studying:

Table I: Number of pupils taking BSCS in 1971-72

Name of curriculum (according to textbook)	Grade	No. of classes	No. of pupils
Biology, the study of life	9	500	18,000
" " " " "	10	300	10,000
" " " " "	11	200	6,000
Experiments and ideas	12	60	1,000

The following were published during the year1971-72:

1. The commercial edition of "Achidut" (Uniformity) appeared in print after extensive re-editing, intended to establish a stronger connection between the text and the laboratory work. Another purpose of this work was to emphasize the role of the laboratory in introducing a subject, and in supplying facts for development of ideas

in class discussions.

2. A new edition of the Teacher's Guide to the text "Biology, the study of life".

3. Questions from the 1969-70-71 matriculation examinations were chosen, rewritten and published together in a booklet called "Collection of problems for the research laboratory".

4. Two booklets of Test Questions paralleling the text "Biology, the study of life".

5. A "Guide to Arthropods" has been put together for publication.

6. Booklets for agricultural and village schools, written by the teams who are preparing material in agro-biology, including the book "Quantitative Biology" which, it is hoped will also be of use in urban schools.

7. Several translated articles on the subject of molecular genetics, for the teaching of research analysis, have appeared in print.

Work planned for the immediate future:-

1. Rewriting the "The Difference" (Shnion) with the addition of chapters on zoology and botany, and taking into account the arrangement of compulsory and free-choice chapters as laid down in the new program.

2. A continuation of the sriting of study units in agro-biology.

Supply Centers

The supply center at Bar-Ilan University has been expanded and now serves not only the BSCS teachers and classes but all the biology teachers in the country. The new center in Jerusalem also offers its services to those interested.

Audio-visual equipment is now available on loan from the centers, but the need to expand the film library is urgent.

There would be great advantage in placing libraries near the supply centers, in order to enable teachers to obtain, in addition to the live materials and audio-visual aids, also books, professional magazines, etc.

Preparation of Teaching Aid Materials

1. Several order for educational slides are now being filled by editing and translating day-light slides. In order to reduce the cost for schools these slides will be in only one color.

2. Several 16 mm films ("The life of the locust", "Rythms of the Sea")

and 8 mm films ("The Rat", "Osmosis", and others) were made in order to widen the present selection available to biology teachers.

3. The Educational Television Service is presenting a series of new programs, in association with the Project staff. The instruction of teachers is also being carried out jointly.

Teacher Instruction

During the past year study days were held every Tuesday at Bar-Ilan University, once every two weeks at the Haifa University, and Tel-Aviv University, and once a month in Jerusalem and the University of the Negev, Beersheva. Several of the instruction courses took place at the Educational Television Offices in Jerusalem.

There is close cooperation between the Science Teaching Center, the Department of Teacher Instruction of the Ministry of Education, and the Universities.

This year we tried to emphasize, in addition to the study of the subject matter itself, the theory and development of teaching methods. We are convinced that special steps will have to be taken to ensure the transfer to the classroom of what is learned in the courses, since this does not occur automatically. We especially stressed this during the course this summer, and during the one on new methods in teaching biology which took place in Jerusalem.

For the coming year, a special instruction course, initiated by Prof. Herman Epstein, is being planned, for teachers who are interested in modern biology. This will be done by analysis of research, by taking part in departmental seminars at the universities, and by work in laboratories.

This year, about 100 study days were held, with an average participation of about 20 teachers.

During the summer, 10 courses, one or two weeks' duration, were held in several cities throughout the country. Of the 300 teachers who participated in these, 60 were new teachers about to join the BSCS program within the framework of Junior High School.

Study program and Matriculation Examinations

There now remain very few schools that are still teaching the former program. Most of the schools that are not actively participating in the BSCS program, teach, in Grades 9-10, a program which is close in spirit to Nuffield-A and in many aspects resembles the BSCS, though using other texts. For Grades 11-12, there are no appropriate texts except those of the BSCS and therefore many use them even if they are not formally classed as BSCS teachers.

With the appointment of the new supervisor for biology education and in the light of what was said above, a new unification program has already been drawn up in general terms, including also the material for the matriculation examinations. Generally, the new program accepts the principles and concepts of the BSCS. It has also been decided that teachers may choose from among the many approved texts available, with the purpose of encouraging the selection of the best texts and the use of a variety of texts and workbooks.

The content and format of the matriculation examinations, as prepared by the BSCS staff, has been accepted in principle throughout the country. In 1972, 600 of those finishing Grade 12 took the BSCS matriculation examinations, and in 1973 the number is expected to increase to 1,000. These numbers are already complicating the organization of the practical examination, and it will clearly be necessary in future to plan in detail the format of the examinations and their implementation. In connection with changes in the matriculation examinations program which make it possible to take the biology examinations at a lower level, the possibility is being considered of utilizing the Grade 7 to 10 material and allowing students who are interested in being examined to take the matriculation examinations already at the end of Grade 10. It is our experience that we can influence and direct the instruction by means of the matriculation examinations, and we believe that such a format as mentioned above, will add considerably to biology instruction in Grades 9-10.

Guidance in the schools

Our efforts to organize this type of guidance have not yet succeeded to our satisfaction. Even though several visits were made to the schools, these were still too few. For the next year we plan to extend out activities in this direction, since we believe in the instruction of the teacher in his school and in his own classroom.

BSCS Teacher Bulletin

This bulletin appeared several times during the last year, but we have not yet managed to make it a permanent institution.

Progress evaluation

The project evaluation, within the planned three year framework, ended with the 1971 matriculation examinations. Results of the follow-up and additional research that accompanied it were published in professional literature abroad. A summarizing article - "Students Growth and Trends Developed as a Result of Studying BSCS Biology for Several Years" - by Drs. Tamir and Yungwirth, gives a comprehensive picture of experiments in this country, the results of which showed

that biology instruction according to BSCS is applicable to the achievement of the stated goals. It was also found that there is a difference between pupils who are taught by different teachers, perhaps implying that the key to improvement is in teacher instruction. For the future we are planning an evaluation directed at students studying "Models and Processes", a text for slow learners but which can also serve as an alternative course for all. In addition, a wide-range research experiment is already under way, for the evaluation of classroom instruction. This experiment is carried out with the aid of questionnaires and planned observations. Special evaluation research of study units in agro-biology is also already being effected.

The matriculation examinations are an additional valuable source of information and they have contributed greatly to our success to date.

In the middle of 1972, a closed circuit television set was purchased which will improve the evaluation work and will also help in the teacher instruction courses and the elevation in general of the instructional level.

Publications

Grade 7

1. Teacher's guide to "Animals and their surroundings", Part II - commercial edition.
2. "Teacher's Anthology" - a collection of articles from the professional literature - internal edition.
3. Booklet "Evaluation" - semi-commercial edition - teacher's anthology - collection of articles on evalaution methods and test building.
4. Three chapters of "Animals and their surroundings", second version, - experimental edition for pupils requiring special education. Three booklets of reading material, corresponding to the three first chapters of the text were also printed. All the material was tried out in 7 experimental classes. Systematic follow-ups for collecting feed-back were made by means of observations in the experimental classrooms, analysis of pupil's worksheets, and by hearing comments of teachers, as well as opinions expressed by specialists and teachers not involved in the experiment.

5. A controlled experiment was carried out, to study the students preference among the literature included in the reading chapters. It was found that they prefer the stury with a plot type rather than an informative article. From the point of view of material achievement, no difference was found.

6. About 40 card indexes for individual work, at various levels of difficulty and in a wide variety of educational activities, were prepared. The card index will be entered into the experimental classes in 1973.

7. A questionnaire was prepared for the follow-up on the commercial publication of "Animals and their surroundings". The survey will include all the teachers teaching the subject and will conclude in 1973.

Grade 8

1. Chapters 1-3 of "Plants and their growth", experimental edition, and teacher's guides for these chapters, were published. These were tested in 16 experimental classes and follow-up for feed back was carried out.

2. Chapters 4 and 5 of "Plants and their growth" were rewritten; chapter 4 was tried out in 16 experimental classes and the results evaluated. Chapter 5 will be tried out in these same classes during the 1972-73 school year.

3. An experimental edition of the reading chapter "Are the forests using up our water resources?" has been published, and will be tried out in schools. It has been decided also to publish it in the form of a simulation game.

4. A series of educational slides was prepared to go with the material in Chapter 4 of "Plants and their growth". The series has been tested and will be re-edited in the light of the results achieved.

Grade 9

A staff, within the framework of Haifa University and in cooperation with the Center for Educational Planning, is working on the preparation of the first chapters on the subject "Man alone and his interference with nature". These chapters will be tried out in 1973.

National Religious Schools

We are working on a teacher's guide for the National Religious School teachers (Junior High School and Senior High School) which will contain a collection of edited original material on the subject "Religion-Science Relations", and also didactic instruction in the treatment of the subject. An experimental edition of the book will be tried out in 1973.

(b) Agro-biology

The first three chapters in Biology and Agriculture are:

1. Heomostasis and self-regulating mechanisms
2. Quantitative biology

3. Reproduction and production - this chapter contains materials for the pupils and for the teacher.

A booklet on Zoo-technology, to accompany the chapter "Reproduction and Production" is in the planning stage. This booklet will include the following:

1. Artificial insemination in farm animals.
2. Pregnancy tests.
3. Photoperiodism.
4. Milking and milking machines.
5. Incubators on poultry farms.

In October 1971, a follow-up of the instruction of these materials was started in 9 schools, (350 pupils in Grades 10- 1). Tests were prepared by Dr. Wengewoort of the Faculty of Agriculture, Hebrew University. It should be added that all the experiments and analyses given in the text were first carried out by the staff members and were tried in several classrooms with pupils before they were included in the material.

Models and Processes

This year "Models and Processes" was taught to a test population in 19 classes in 10 schools, to a total of 541 students. Next year we shall attempt certain technical arrangements, designed to give the teacher a freer hand in constructing a curriculum of topics suitable to his particular classes.

Feedback, from both teachers and students, indicates a high degree of acceptance of the program and its suitability for the specific populations. Criticisms concerning the use of Booklet A rather than B or C as the introductory topic have been received and will be acted upon.

It is recommended that high level consideration be given to the following:

a. Increase of hours of instruction from 2 to 3 per week.
b. The factor of class size, especially for this population group.
c. The establishment of uniform criteria for placement of students in specially designed programs.
d. The recommendation that all four booklets be purchased, at the outset of the sequence, in 9th grade.

5. Agriculture (Grades 7-9)

A. "Let's grow plants" for Arabic speaking schools

The program in agriculture was translated to Arabic and adapted to the specific problems arising in science education in the Arabic language schools. In the translation of this material, it was especially necessary to give special consideration to the discussion of concepts taken from Jewish sources and folklore; these had to be substituted by illustrations familiar to the experience of the Israeli Arab farmer. Also, several pictures depicting the farmer and his surroundings were changed.

The program was tried out in ten schools, and the teachers participating in the experiment met once every two weeks for discussions and instruction. They also received instruction, in the school, from a staff member who visited there periodically.

Study days were also organized for school principals, supervisors and heads of local committees, to facilitate the acceptance of changes even in small villages.

This experiment in agricultural education serves as a workshop and model for those responsible for the Arabic language science programs.

B. Experiment on the topic "Let's protect the plants"

This subject is the central and most important part of Course 2 in Junior High School agriculture. It was tried out in its second edition in twenty schools all over the country. In several places the program was tried out in the framework of afternoon courses.

The subject contains three chapters:

1. Poisonous plants and their control
2. On rust and moulds (plant diseases caused by fungi)
3. Pest control problems

Even though these chapters complement each other, they may be taught separately.

The pupils' booklet was rewritten, additional experiments were developed, reading segments and multiple choice examinations were prepared. The teacher's guide, first edition, has already been published.

Teachers' meetings were held every week, in the afternoons. We learned of the problems connected with the supply of live materials, a problem that can be solved only by a central supply center as is utilized in the BSCS program.

C. Development of the subjects "Let's grow bees" and "Let's grow chicks".

Whereas we have hitherto concentrated on the world of plants, this year we began the development of alternative programs in animal husbandry with animals that can be kept in the school.

In an early experiment, we studied how a group of 15-20 pupils could work on a bee-hive and make observations. Cheap protective clothing was developed. Three chapters on the subject were written - "First encounters with the bee-hive", "Food of the larvae", "The bee as architect".

For the subject "Let's grow chicks", an educational incubator and a feeding system suitable for schools were developed.

The staff began writing the chapters "From egg to chick", "Immunization of chicks", and "Balanced nutrition".

D. "War on Hunger"

From a preliminary experiment it became clear that except for several field experiments connected with types of cultivation and care for choice strains, new teaching methods have to be found for this integrative subject. A great amount of reading material was collected for discussion. Students (and teachers) got used to working in libraries and reporting their findings in the classroom.

E. Vocational education

According to the main program of the education reform, Grade 9 will be taught at three levels. Level-3 is intended for those pupils who seem unlikely to take the matriculation examinations or the national finals. They will receive additional lessons in pre-vocational courses:

1. Growing in hot-houses and plants under protection - mainly for village schools.
2. Gardening - mainly for rural schools.

F. Development of the subject "Growth material in agriculture"

This topic is interesting from a biological point of view, and also very important from the agricultural point of view. The chapter in the BSCS "The study of life", dealing with plant hormones is short and outdated, and does not fill the needs of settlement schools interested in agro-biology. It was therefore decided to prepare educational material on "Growth materials in agriculture" for Grades 10-11.

Many experiments were developed dealing with agriculture and biological aspects of the utilization of growth materials.

After preliminary trial of the experiments in the schools, they were partly improved and connecting segments between the experiments and students' text are now being written.

G. A teachers' bulletin on the subject "Let's grow plants" was published, containing background material for teachers. The purpose of this bulletin is to complement the teacher's guide by giving additional information, and to enable teachers to introduce some variety into the material they teach.

Preliminary discussions were held on the problems arising when ground is left to lie fallow. Suggestions are being prepared to make the program suitable for a sabbatical year.

Courses, for new and experienced teachers, on "Let's grow plants" were held this summer, as well as study days on the teaching of agriculture for teachers participating in experimental trials of the program and for supervisors.

A master plan for biology is being prepared. This program is intended for Grades 1-6 of agricultural schools.

6. Junior School Program

"MATAL" - Science for Kindergarten and Elementary Schools - Tel-Aviv Group.

Introduction

The group at Tel-Aviv University has been working for the past four years on the development of study programs in science for kindergarten and elementary schools. The project was initiated by Mr. Feuchtwanger with the help of Prof. Kaplan, and began to receive support from the Science Teaching Center in 1969.

The problems encountered arise from the special nature of the elementary school - the psychological problems involved in understanding scientific concepts at an early age, the large numbers (500,000 students and 24,000 teachers) involved in the experiment, problems involving the quality of present educational program and teaching methods, and the inadequate preparation of elementary school teachers in science education. Since this link in the educational chain has for so long been neglected, the "MATAL" project faces special problems that go beyond the development of a study program in elementary school science. The project is therefore trying to develop a new study program in science, to be an integral part of the whole educational process.

The first study program that was suggested by the Tel-Aviv University group was revised and re-written, and after it was approved by the Pedagogical Secretariat of the Ministry of Education in July 1972, it became the basis for the group's work.

This program specifies:

1. The purposes of science teaching in elementary school.
2. Description of teaching methods.
3. Basic concepts which guide the program.
4. Details of study units.
5. Appendices dealing with teacher instruction, and with the supply and maintenance of equipment.

According to the suggestion of the group the program will undergo yearly revision, utilizing all that can be gathered from experience in the field and from research.

The development of a study unit takes two years and involves the following: research, initial development - 2 trials, one in 3-4 classes and a second in 7 classes, rewriting, and re-typing. After the second typing is completed the units are again tried out a larger scale.

Study units in different stages of development:

Kindergarten	Exp. stage	Typing stage
1. Knowing the surroundings	2-completed	in prep for 1st typing
2. Senses and sensations	3-completed	" " " 2nd "
3. Lines and forms	3-completed	" " " 2nd "
4. Classification	3-completed	" " " 2nd "
Grades 1-3		
5. Classification	I - 2-completed II - development for individual instruction (exp.- 2)	" " " 2nd " in prep. for 1st typing
6. Living creatures and their environment	3-completed	" " " 2nd "
7. Substances, materials and their properties	3-completed	" " " 2nd "
8. Man and his health	3-completed	2nd typing completed
9. Magnets	2-completed	in prep. or 2nd typing
10. Life cycle	3-completed	" " " 2nd "
11. Animal and plant behaviour	2-in progress	1st typing completed
12. Reciprocal action in a system - a. Electric cycle	2-in progress	in prep. for 2nd typing
13. Reciprocal action in a system - b. Mechanical transmission - development in progress		

Grades 4-5

14. Living organisms and their surroundings (ecology) - in preparation for 1st experiment
15. Salts, solutions and reactions 1-completed in prep. for 1st typing
16. Light and sight
17. Sound and hearing - in preparation for 1st experiment
18. The earth we live on
19. The surroundings as a system of activity, time and space- in preparation for 2nd experiment
20. Our body, a,b,
21. Individuals and populations
22. Sources of energy - development in progress

Since elementary school teachers do not receive adequate training in science education within the framework of the seminars, and since their number is approximately 24,000, in-service training programs for such a population have to overcome problems not encountered in other areas of in-service training.

The MATAL group prepared a proposal for in-service instruction on the following basis:

1. Group of guidance counsellors
2. Pioneering team of schools, a guidance counsellor in each school
3. Groups of schools attached to the pioneer schools.

The MATAL group, with the cooperation of the supervisor of science education, will train the guidance counsellors. These, in turn, will organise regional in-service training courses in their school - the pioneer school - with the cooperation of the principal and the science education supervisor.

During the past year the following stages of the proposal were carried out:

1. The preparation of a team of 30 guidance counsellors, in three stages:
   a. Summer 1971 - 3 weeks of instruction
   b. Series of meetings including study days, 1971-1972
   c. Summer 1972 - 3 weeks of instruction and practical work

2. Creation of a team of 30 pioneering schools throughout the country.

Five study days were held during 1971-72 for school principals. These included - familiarization with the new study program, discussions about new teaching methods, lectures by guests Prof. Goodlad, Dr. Harlen and Prof. Kaplan (through the aid of UNESCO). Members of

the Tel-Aviv group are active in visiting and advising this group of schools.

3. During this past school year, 30 guidance counsellors began their activities in their schools, two days a week (the time alloted to them for this purpose by the Ministry of Education).

4. In cooperation with the Science Education Supervisor, teacher instruction courses were held during the summer of 1972 in four cities: Tel-Aviv, Jerusalem, Haifa, and Beer-Sheva. The courses were planned for 50 kindergarten teachers and 400 elementary school teachers. As a result of pressure from schools and teachers alike, finally 80 kindergarten and 700 school teachers participated.

The program of the course included:

a. Lectures on general science and psychology.
b. Laboratory instruction on methods of working in chemistry, physics and biology laboratories.
c. Group instruction.
d. Group work.
e. Field tours.
f. Introduction to study units.
g. Workshops in individual instruction.

During 1971 a modular program for the training of teachers was developed. The purpose of the program is to build independent study units in the natural sciences which could be adapted to the special needs of the elementary school teacher in Israel.

The following units were developed and tested:

a. Basic methods in Chemistry A, B.
b. Laboratory methods in Bacteriology A.
c. Laboratory methods in Physics - Electricity A.
d. Group instruction.

Within the framework of the preparation of guidance systems for the guidance councellors and the team of pioneer schools, a modular study program for teacher training was developed in cooperation with the Educational Television, in three areas:

a. Teaching methods
b. Developmental psychology
c. Specific instruction

The following have already been prepared in these areas:

1. Lesson versus lesson - a 16 mm movie (black and white, 20 min.) that deals with situations that a teacher may encounter in a frontal lesson and in group instruction. An introductory pamphlet with background material and topics for exercises is being prepared.

2. The development of thinking in the child - 16 mm movie (color, 25 min). Pamphlet with background material, series of laboratory experiments and tests and aids for the tests have been prepared.

The following four color films (3 min. each) are in various stages of development and production.

1. Lesson in wondering.
2. Lesson in research and discovery.
3. Unit on the teaching of electricity.
4. Teaching behavior.

These modules could be used for the training of teachers in seminars and universities.

Training teachers in individual instruction

In cooperation with the Center for Educational Technology, a preliminary experiment was carried out this last year, to define the problems and needs connected with the implementation of individual instruction methods. The Grade 1 classification unit was revised for individual instruction, an experimental workshop for teacher training in individual instruction was developed and tried out, and as a result a program of research and development in this area crystallized:

1. The training of manpower to specialize in individual instruction.
2. The development of 2-3 experimental units, appropriate for testing the individual instruction methods.
3. Development of methods for training teachers.
4. Experimentation in the schools.

The following has already been done:

1. The writing of a unit on individual instruction for teachers has been completed and tried out in 3 workshops during the summer of 1972.
2. 25 teachers were trained in a workshop during the summer of 1972.
3. Work on an individual instruction unit in classification is now being completed.
4. A joint project with the "Bezalel" School of Design was initiated with the purpose of planning a classroom for individual instruction.

Equipment - research, development and supply

The study program developed by the Tel-Aviv Group requires a great deal of educational equipment. The subject of equipment for the young and especially for elementary schools is a new one, not only for Israel. It requires research and development in the planning of educational aids, and the study of the logistics of production and supply

to the schools, and maintenance. MATAL is in contact with several companies in order to stimulate industry for the elementary school and kindergarten. It has also prepared a proposal for the establishment of supply centers for educational equipment, under the Ministry of Education. A research and development group at Tel-Aviv University has been organized, as well as a workshop for the building of prototypes.

Evaluation

With the development of study units for kindergarten and Grades 1-3, we have begun to develop tools for evaluation. Through the generous help of UNESCO, Dr. W. Harlan (Bristol S/B Project) was enabled to spend the summer of 1972 with the group and gave valuable help in the initiation of this work.

Within the framework of the group's activities the following evaluation tools were developed:

1. Questionnaire for the teacher
2. " " " principal
3. " " " controller
4. " A for kindergarten controller
5. " B " " "
6. " for kindergarten teachers
7. Model program in 100 classes for evaluation research
8. Computer programs for evaluation research

These were edited and rewritten during a 2-day workshop in which 30 guidance counsellors, the supervisory body on science education, and the whole MATAL group participated. The evaluation experiment is planned to begin in November 1972 as soon as the Ministry of Education supplies the necessary equipment to the experimental classes.

The MATAL programs are implemented in the schools by the supervisory body on science education with the help of the MATAL group. With the completion of stage 1 in the development of the study units for kindergarten and Grades 1-3 (2 units per grade) including equipment, 160 schools, 80 kindergartens, about 1200 teachers and kindergarten teachers and about 40,000 pupils will be using them.

The problems in activating the program are as follows:

1. The lack of continuous instruction facilities
2. The difficulty of ensuring a constant supply of equipment and spare parts, and of upkeep.
3. The lack of means of supplying living material.
4. The lack of physical conditions in the schools (classrooms are poorly furnished and lack of water and power sources, inadequate sotrage space, no possibility of cleaning, etc).